Citation 3

LASER WORKING DEVICE

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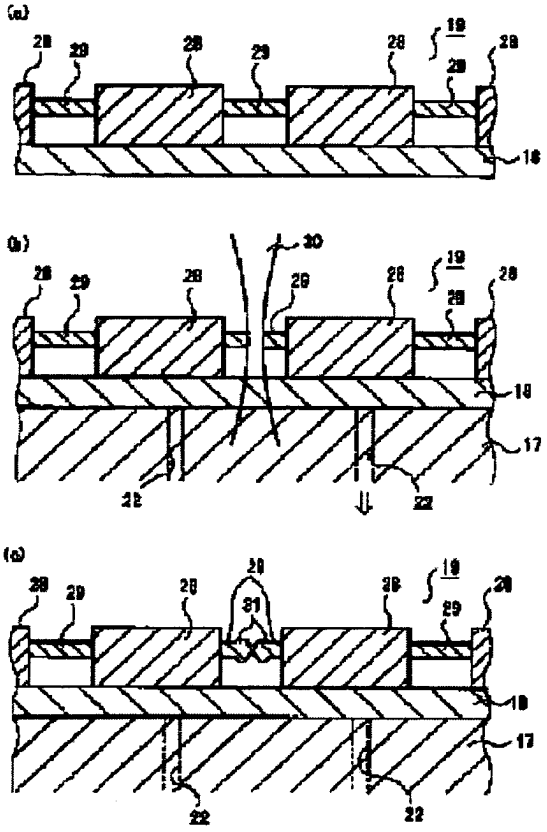
Abstract of **JP2000164535**

PROBLEM TO BE SOLVED: To provide a laser working device, capable of easily mounting or dismounting a work without degrading the quality of the work. SOLUTION: A laser working device, for irradiating a semiconductor wafer 19 with a laser beam 30 and melting down the semiconductor wafer, has a fixing sheet member 18 made of a material which transmits the laser beam 30 and for bonding and fixing the semiconductor wafer 19 having a portion absorbing the laser light 30, and a mounting base 17 made of a material which transmits the laser beam 30 and for mounting and fixing the fixing sheet member 18.



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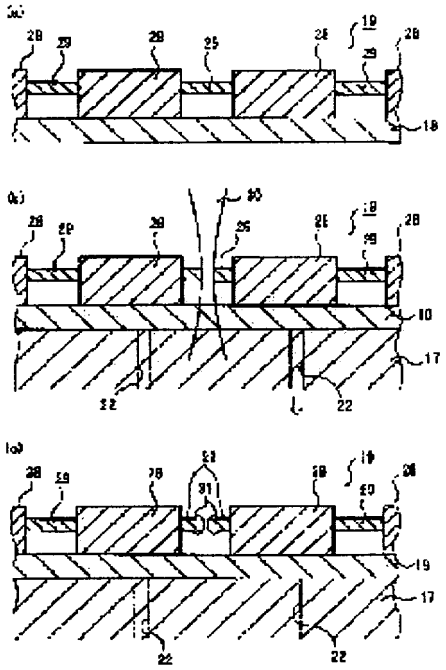
(54) LASER WORKING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a laser working device, capable of easily mounting or dismounting a work without degrading the quality of the work.

SOLUTION: A laser working device, for irradiating a semiconductor wafer 19 with a laser beam 30 and melting down the semiconductor wafer, has a fixing sheet member 18 made of a material which transmits the laser beam 30 and for bonding and fixing the semiconductor wafer 19 having a portion absorbing the laser light 30, and a mounting base 17 made of a material which transmits the laser beam 30 and for mounting and fixing the fixing sheet member 18.



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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] A workpiece can be easily detached and attached from laser-beam-machining equipment, without starting laser-beam-machining equipment for this invention performing chip separation of the semiconductor device of a semi-conductor wafer as a workpiece, and reducing the quality of a workpiece.
[0002]
[Description of the Prior Art] Conventionally, as the chip separation approach of a semi-conductor wafer, there was a dance cut method by the diamond wheel. This approach is an approach one side sticks a wafer on the sheet-like ingredient which changes with adhesive tape, cuts a little sheet-like ingredient deeply, and cuts a wafer completely. However, by this approach, since there were many rates of the metallic material in the separation section, when the thickness of the separation section was set to 100 micrometers or less, there were metaled weld flash and a trouble that a crack occurred to a wafer.
[0003] As an approach for solving that, the method of performing chip separation of a semi-conductor wafer to JP,8-264491,A in a laser beam is proposed. Drawing 5 R> 5 is drawing showing the chip separation approach of the semiconductor device in JP,8-264491,A. It is based on a Fig. below and the approach of chip separation of a semi-conductor wafer is explained.
[0004] First, when the semi-conductor wafer 3 as a workpiece connected, respectively in the metal section 2 of which between each semiconductor device 1 consists with nickel excellent in absorption of a laser beam is formed as shown in drawing 5 (a) for example, this semi-conductor wafer 3 is pasted up on the adhesion side side of the firmly attached seat member 4 which has an adhesive property on one side, and it fixes (drawing 5 (b)). Next, as shown in drawing 6 , it is held after the stop ring 5 has pulled the perimeter of the firmly attached seat member 4, and the semi-conductor wafer 3 will be in the condition that it is held in the air.
[0005] And this stop ring 5 is being fixed to the body section 6 of laser-beam-machining equipment with the fixed jig 7. Next, a laser beam 8 is irradiated with a desired beam diameter at the metal section 2 of the semi-conductor wafer 3 (drawing 5 (c)). And a dissolution part melts with surface tension, the metal section 2 separates, is carried out [it fuses, and], the dissolution coagulation section 9 is formed, and each semiconductor device 1 is separated (drawing 5 (d)).
[0006] Then, the firmly attached seat member 4 is removed from laser-beam-machining equipment. Next, the firmly attached seat member 4 is pulled and lengthened, and between each separated semiconductor device 1 is extended. If it does in this way, each semiconductor device 1 can be easily removed from the firmly attached seat member 4.
[0007] If each semiconductor device 1 is separated as mentioned above, while irradiating the laser beam 8, the temperature of the semi-conductor wafer 3 rises and the location of elongation and the semi-conductor wafer 3 under processing moves [the firmly attached seat member 4] vertically and horizontally in connection with this. For this reason, focal gap of a laser beam 8 arose during processing, and there was a trouble that process tolerance fell.
[0008] In order to solve this, as shown in drawing 8 , the installation base 11 equipped with many holes 10 for adsorption is formed on the body 6 of laser-beam-machining equipment, and the firmly attached seat member 4 to which the semi-conductor wafer 3 was fixed is laid on this installation base 11. Next, in order to stick the perimeter of the firmly attached seat member 4, and the top face of the installation base 11, it presses down with the fixed jig 12 from on the firmly attached seat member 4.

[0009] Next, opening wide the bulb 15 of the vacuum pump 13 which was open for free passage in the hole 10 for adsorption, and checking with the vacuum gage 14, desired negative pressure is applied from the hole 10 for adsorption with a vacuum pump 13, and the installation base 11 is made to carry out vacuum adsorption of the firmly attached seat member 4. Next, it is processed like the above-mentioned conventional case by the laser beam 8, maintaining this condition (drawing 7 (a)). And a dissolution part melts with surface tension, the metal section 2 separates, is carried out [it fuses, and], the dissolution coagulation section 9 is formed, and each semiconductor device 1 is separated (drawing 7 (b)).
[0010] Then, while stopping a vacuum pump 13, a bulb 15 is closed and it opens wide to atmospheric pressure, and vacuum adsorption is canceled, and the firmly attached seat member 4 is removed from laser-beam-machining equipment. Next, the firmly attached seat member 4 is pulled and lengthened, between each separated semiconductor device 1 is extended, and each semiconductor device 1 is removed from the firmly attached seat member 4.
[0011] If such laser-beam-machining equipment is used, since the solid-state sheet member 4 is fixed on the installation base 11, it is canceled and gap of the firmly attached seat member 4 at the time of the exposure of a laser beam 8 can perform processing excellent in precision.
[0012] Without damaging a laser beam 8, the quality of the material of the installation base 11 used here is excellent in process tolerance, and, generally can consider use of acetal resin from points, such as low cost. However, as shown in drawing 9 , when a laser beam 8 is irradiated, although the permeability of a laser beam 8 penetrates the firmly attached seat member 4 highly, the permeability of a laser beam 8 is inferior in the installation base 11 formed with acetal resin, and it causes absorption of a laser beam 8.
[0013] Then, although melting does not result, temperature rises (for example, the rise to about 100 degrees C can be considered), the firmly attached seat member 4 is also heated by this heating, the firmly attached seat member 4 pastes the installation base 11, and it becomes impossible for the part where the laser beam 8 of the installation base 11 was irradiated to remove the firmly attached seat member 4 easily from laser-beam-machining equipment, and it changes with causes, such as damage on the semi-conductor wafer 3.
[0014] Moreover, in order to perform vacuum adsorption, dust etc. invades in the hole 10 for adsorption formed in the installation base 11, a laser beam 8 is irradiated, is heated by that dust, the firmly attached seat member 4 is heated by this heating, and it is possible to produce the same phenomenon as the above-mentioned case.
[0015]
[Problem(s) to be Solved by the Invention] When it was constituted as mentioned above, the firmly attached seat member 4 pasted the installation base 11 and conventional laser-beam-machining equipment removed the semi-conductor wafer 3 of a workpiece from laser-beam-machining equipment, the semi-conductor wafer 3 was damaged and it had the trouble that quality deteriorated. Moreover, when the firmly attached seat member 4 was fixed on the installation base 11 by vacuum adsorption, since the whole surface of the firmly attached seat member 4 touched on the installation base 11, balking of the firmly attached seat member 4 became difficult from the installation base 11, and after vacuum disconnection damaged the semi-conductor wafer 3, and had the trouble that quality deteriorated.
[0016] This invention aims at offering the laser-beam-machining equipment which can detach and attach a workpiece easily, without having been made in order to cancel the above troubles, and reducing the quality of a workpiece.
[0017]
[Means for Solving the Problem] The laser-beam-machining equipment of claim 1 concerning this invention The firmly attached seat member which changes with the quality of the material which pastes up the workpiece which has the part which absorbs a laser beam, and is fixed, and penetrates a laser beam, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed, irradiates a laser beam at a workpiece, and melts a workpiece an installation base It is formed with the quality of the material in which an installation base and a firmly attached seat member touch, and the laser radiation section corresponding to the processing field of a workpiece penetrates a laser beam.
[0018] Moreover, in claim 1, as for the laser-beam-machining equipment of claim 2 concerning this invention, the laser radiation section of an installation base is formed with glass, using an YAG laser as a laser beam.
[0019] Moreover, the laser-beam-machining equipment of claim 3 concerning this invention The firmly

attached seat member which changes with the quality of the material which pastes up the workpiece which has the part which absorbs a laser beam, and is fixed, and penetrates a laser beam, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed, irradiates a laser beam at a workpiece, and melts a workpiece an installation base The laser radiation section which an installation base and a firmly attached seat member touch, and corresponds with the processing field of a workpiece is formed with the quality of the material which reflects a laser beam.
[0020] Moreover, in claim 3, as for the laser-beam-machining equipment of claim 4 concerning this invention, the laser radiation section of an installation base is formed with copper, gold, or aluminum, using an YAG laser as a laser beam.
[0021] Moreover, the laser-beam-machining equipment of claim 5 concerning this invention is equipped with the firmly attached seat member which pastes up the workpiece which has the part which absorbs a laser beam, and is fixed, and the installation base which lay a firmly attached seat member and fixes by vacuum adsorption, and the hole for adsorption for carrying out vacuum adsorption of the firmly attached seat member of an installation base is formed in the outside of the processing field of a workpiece in the laser-beam-machining equipment which irradiates a laser beam at a workpiece and melts a workpiece.
[0022] Moreover, the laser-beam-machining equipment of claim 6 concerning this invention deforms a firmly attached seat member along with the concave of an installation base at the time of vacuum adsorption by forming the upper part of an installation base in the concave of a reverse trapezoid, and equipping the periphery section of a concave pars basilaris ossis occipitalis with the hole for adsorption in claim 5, and vacuum adsorption is carried out on an installation base.
[0023] Moreover, the laser-beam-machining equipment of claim 7 concerning this invention The firmly attached seat member which pastes up the workpiece which has the part which absorbs a laser beam, and is fixed, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed by vacuum adsorption, irradiates a laser beam at a workpiece, and melts a workpiece The hole for adsorption is equipped with the pressurization means to which the atmospheric pressure more than atmospheric pressure is applied at the time of balking of the firmly attached seat member from the hole for adsorption and installation base for carrying out vacuum adsorption of the firmly attached seat member of an installation base.
[0024]
[Embodiment of the Invention] The gestalt of implementation of this invention is explained below gestalt 1. of operation. Drawing in which drawing 1 shows the configuration of the laser-beam-machining equipment of the gestalt 1 of operation of this invention, and drawing 2 are drawings for explaining the processing approach using the laser-beam-machining equipment shown in drawing 1 . In drawing 1 , it is the installation base where 16 was formed in the body of laser-beam-machining equipment, and 17 was formed on this body 16, and is formed with the quality of the material which penetrates a laser beam.
[0025] 18 is the firmly attached seat member which pastes up the semi-conductor wafer 19 as a workpiece which has the part which absorbs a laser beam, and is fixed, and one side is formed in a glue line and it changes with the quality of the material which penetrates a laser beam. A fixed jig for the stop ring for holding 20, where the perimeter of the firmly attached seat member 18 is pulled, and 21 to stick the firmly attached seat member 18 and the top face of the installation base 17, and 22 are the holes for adsorption established in the installation base 17, and are for performing vacuum adsorption with the installation base 17 and the firmly attached seat member 18. [many]
[0026] The pressurization means to which the atmospheric pressure more than atmospheric pressure is applied, and 27 are the 2nd bulb for opening and closing this pressurization means 26 by a vacuum gage for the 1st bulb for the vacuum pump which 23 opens for free passage in the hole 22 for adsorption, and 24 opening and closing this vacuum pump 23, and 25 checking the negative pressure by the vacuum pump 23, and 26 being opened for free passage by the hole 22 for adsorption, for example, supplying desiccation Ayr to this adsorption hole 22.
[0027] In drawing 2 , it is the part to which 28 is connected to with a semiconductor device and 29 is connected between each semiconductor device 28 and which absorbs a laser beam, for example, the semi-conductor wafer 19 as a workpiece is constituted by the metal section which changes with nickel excellent in absorption of a laser beam, these semiconductor devices 28, and the metal section 29. 30 is a laser beam for processing a workpiece. Here, suppose that the quartz glass which was excellent in the permeability of an YAG laser considering the YAG laser (that whose wavelength is 1.06 micrometers) as an installation

base 17 is used as a laser beam 30, respectively.
[0028] Next, the processing approach of the laser-beam-machining equipment of the gestalt 1 the operation constituted as mentioned above is explained. First, like the conventional case, the semi-conductor wafer 19 is pasted up on the firmly attached seat member 18, and it fixes (drawing 2 (a)). Next, the firmly attached seat member 18 is laid on the installation base 17. Next, after the stop ring 20 has pulled the perimeter of the firmly attached seat member 18, it holds.
[0029] Next, it presses down with the fixed jig 21 from the top face around the firmly attached seat member 18, and the perimeter of the firmly attached seat member 18 and the top face of the installation base 17 are stuck. Next, opening the 1st bulb 24 wide, operating a vacuum pump 23, and checking with the vacuum gage 25, desired negative pressure is applied from the hole 22 for adsorption, and the installation base 17 is made to carry out vacuum adsorption of the firmly attached seat member 18.
[0030] Next, a laser beam 30 is irradiated with a desired beam diameter at the metal section 29 of the semi-conductor wafer 19, maintaining this condition (drawing 2 (b)). Under the present circumstances, although a laser beam 30 is irradiated by the firmly attached seat member 18 and the installation base 17, temperature does not rise and the firmly attached seat member 18 and the installation base 17 are not pasted [each other] up in order to penetrate a laser beam 30.
[0031] And a dissolution part melts with surface tension, the metal section 29 separates, is carried out [a laser beam 30 is absorbed, temperature rises melting is carried out,], the dissolution coagulation section 31 is formed, and each semiconductor device 28 is separated (drawing 2 (c)). Next, while closing the 1st bulb 24, actuation of a vacuum pump 23 is suspended. Next, the 2nd bulb 26 is opened wide, desiccation Ayr is supplied to the hole 22 for adsorption from the pressurization means 26, and the pressure more than atmospheric pressure (for example, 1.5 atmospheric-pressure extent is assumed) is put. And it is made to secede from the firmly attached seat member 18 automatically from the installation base 17.
[0032] Next, the firmly attached seat member 18 is pulled and lengthened, between each separated semiconductor device 28 is extended, and each semiconductor device 28 is removed from the firmly attached seat member 18.
[0033] According to the laser-beam-machining equipment of the gestalt 1 of the operation formed as mentioned above, at the time of laser beam machining, since a laser beam 30 is penetrated and such temperature hardly rises, the firmly attached seat member 18 and the installation base 17 do not paste up the firmly attached seat member 18 and the installation base 17. Therefore, it can secede from the firmly attached seat member 18 easily from laser-beam-machining equipment, without doing damage to the semi-conductor wafer 19 after processing.
[0034] Moreover, since the firmly attached seat member 18 secedes from the installation base 17 automatically by putting the pressure more than atmospheric pressure from the hole 22 for adsorption in the case of the balking, it can be made to secede from the firmly attached seat member 18 still more easily from laser-beam-machining equipment.
[0035] There is no ******. in addition, in the gestalt 1 of the above-mentioned implementation, although the example which forms all the installation bases 17 with the quality of the material which has the permeability of a laser beam was shown, restrict to this -- If formed with the quality of the material in which the installation base 17 and the firmly attached seat member 18 touch among the installation bases 17 at least, and the laser radiation section corresponding to the processing field of the semi-conductor wafer 19 penetrates a laser beam 30 Cost is reducible, if to say nothing of doing so the same effectiveness as the gestalt 1 of the above-mentioned implementation only a required field is formed with glass when using [for example,] the expensive quality of the materials, such as glass.
[0036] Although the gestalt 1 of the gestalt 2. above-mentioned implementation of operation showed the example formed with the quality of the material in which the installation base 17 penetrates a laser beam 30, even if it forms an installation base with the quality of the material which reflects a laser beam, the same effectiveness as the gestalt 1 of the above-mentioned implementation can be done so.
[0037] Drawing 3 is drawing having shown the part and its processing approach of the laser-beam-machining equipment in the gestalt 2 of implementation of this invention. In drawing, the same part as the gestalt 1 of the above-mentioned implementation attaches the same sign, and omits explanation. A laser beam for 32 to process the semi-conductor wafer 19 as a workpiece and 33 are the installation bases for laying the firmly attached seat member 18, and are formed with the quality of the material which reflects a laser beam. 32a is the reflected light which the laser beam 32 reflected on the installation base 33. Here, the

installation base 33 shall form an YAG laser as a laser beam 32 with copper excellent in reflection of an YAG laser, gold, or aluminum.

[0038] Next, the processing approach of the laser-beam-machining equipment of the gestalt 2 the operation constituted as mentioned above is explained. First, like the gestalt 1 of the above-mentioned implementation, after making the installation base 33 carry out vacuum adsorption of the firmly attached seat member 18, as shown in drawing 3 (a), a laser beam 32 is irradiated with a desired beam diameter at the metal section 29 of the semi-conductor wafer 19. Under the present circumstances, although a laser beam 30 is irradiated by the firmly attached seat member 18 and the installation base 33, the firmly attached seat member 18 penetrates a laser beam 32, on the installation base 33, a laser beam 32 reflects, and changes with reflected light 32a, and does not absorb a laser beam 32. Therefore, such temperature hardly rises and pasting up mutually is prevented.

[0039] Henceforth, it carries out by the same approach as the gestalt 1 of the above-mentioned implementation, and the metal section 29 absorbs a laser beam 32, temperature rises, and is dissolved, the dissolution coagulation section 31 is formed, and each semiconductor device 28 is separated (drawing 3 (b)). And it secedes from the installation base 33 from the firmly attached seat member 18, and each semiconductor device 28 is removed from the firmly attached seat member 18.

[0040] According to the gestalt 2 of the operation constituted as mentioned above, not to mention doing so the same effectiveness as the gestalt 1 of the above-mentioned implementation, that what is necessary is just to form with the quality of the material in which a laser beam 32 reflects the installation base 33, as compared with glass, it is easy to process copper, gold, or aluminum, and its worries about breakage decrease.

[0041] In addition, although the example formed in the gestalt 2 of the above-mentioned implementation with the quality of the material in which all the installation bases 33 reflect a laser beam 32 was shown, it is not restricted to this. If formed with the quality of the material in which the installation base 33 and the firmly attached seat member 18 touch among the installation bases 33 at least, and the laser radiation section corresponding to the processing field of the semi-conductor wafer 19 reflects a laser beam 32 The case where it changes with the quality of the material in which only the front face of the installation base 33 reflects a laser beam 32 to say nothing of doing so the same effectiveness as the gestalt 2 of the above-mentioned implementation etc. can be considered.

[0042] Gestalt 3. drawing 4 of operation is drawing showing the configuration and processing process of laser-beam-machining equipment of operation in this invention. [of a gestalt 3] In drawing, the same part as the gestalt of each above-mentioned implementation attaches the same sign, and omits explanation. It is possible that 34 is formed with the quality of the material which is the installation base which lays the firmly attached seat member 18 and is fixed by vacuum adsorption, for example, penetrates a laser beam, or the quality of the material which reflects a laser beam. The crevice of a reverse trapezoid where 34a was formed in the upper part of the installation base 34, and 35 are the hole for adsorption formed in the periphery section of the pars basilaris ossis occipitalis of crevice 34a of a reverse trapezoid while being formed in the outside of the processing field of the semi-conductor wafer 19.

[0043] Next, the processing process of the laser-beam-machining equipment of the gestalt 3 of the operation constituted as mentioned above is explained. First, the firmly attached seat member 18 is laid on the installation base 34 like the gestalt of each above-mentioned implementation (drawing 4 (a)). Next, opening the 1st bulb 24 wide, operating a vacuum pump 23, and checking with the vacuum gage 25, desired negative pressure is applied from the hole 35 for adsorption, and the installation base 34 is made to carry out vacuum adsorption of the firmly attached seat member 18 (drawing 4 (b)). Under the present circumstances, the firmly attached seat member 18 deforms into the configuration of crevice 34a of a reverse trapezoid of the top face of the installation base 34, and is adsorbed so that clearly also from drawing 4 (b).

[0044] Thus, since the inside [hole / 35 / of the installation base 34 / for adsorption] is formed lower than an outside [hole / 36 / for adsorption], even if the hole 35 for adsorption is formed in the outside of the processing field of the semi-conductor wafer 19 of the installation base 34 in the case of vacuum adsorption, vacuum adsorption can be performed, without air bubbles remaining between the installation base 34 and the firmly attached seat member 18.

[0045] Next, the semi-conductor wafer 19 is processed in a laser beam like the gestalt of each above-mentioned implementation. Under the present circumstances, since the hole 35 for adsorption is formed in the outside of the processing field of the semi-conductor wafer 19, a laser beam is not irradiated by the hole

35 for adsorption. Therefore, it is not heated even if dust etc. exists in the hole 35 for adsorption.
[0046] Next, while closing the 1st bulb 24, actuation of a vacuum pump 23 is suspended (drawing 4 (a)). Then, the firmly attached seat member 18 separates from crevice 34a of a reverse trapezoid of the installation base 34, and returns to the original condition. And like the gestalt of each above-mentioned implementation, it secedes from the installation base 34 from the firmly attached seat member 18, and the semi-conductor wafer 19 is removed from the firmly attached seat member 18.
[0047] According to the gestalt 3 of the operation constituted as mentioned above, not to mention doing so the same effectiveness as the gestalt of each above-mentioned implementation, heating by the dust in the hole 35 for adsorption etc. is prevented, and the fault by the firmly attached seat member 18 being heated can be canceled.
[0048] In addition, in the gestalt of each above-mentioned implementation, although the example using a semi-conductor wafer as a workpiece was shown, things have the effectiveness excellent in that of which detailed processing is required needless to say especially that what is necessary is just the workpiece which has the part which is not restricted to this and absorbs a laser beam. Moreover, although the example which cuts between the semiconductor devices of a semi-conductor wafer was shown, to say nothing of things, the same effectiveness is done so that what is necessary is just processing which is not restricted to this, for example, uses fusing by laser beams, such as punching processing. Moreover, the atmospheric pressure more than atmospheric pressure is applied to the hole for adsorption for balking by vacuum adsorption with an installation base and a firmly attached seat member, and from an installation base, if it secedes from a firmly attached seat member as it floats, the damage to a workpiece can be prevented.
[0049]
[Effect of the Invention] As mentioned above, the firmly attached seat member which changes with the quality of the material which pastes up the workpiece which has the part which absorbs a laser beam according to claim 1 of this invention, and is fixed, and penetrates a laser beam, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed, irradiates a laser beam at a workpiece, and melts a workpiece an installation base Since it is formed with the quality of the material in which an installation base and a firmly attached seat member touch, and the laser radiation section corresponding to the processing field of a workpiece penetrates a laser beam It is prevented that an installation base is heated, it can secede from a sheet member easily from an installation base, and becomes possible [offering the laser-beam-machining equipment which can prevent damage on a workpiece].
[0050] Moreover, since it can perform certainly that an installation base penetrates a laser beam in claim 1 since the laser radiation section of an installation base is formed with glass, using an YAG laser as a laser beam according to claim 2 of this invention, it can secede from a sheet member easily from an installation base, and it becomes possible to offer the laser-beam-machining equipment which can prevent damage on a workpiece.
[0051] Moreover, the firmly attached seat member which becomes with the quality of the material which pastes up the workpiece which has the part which absorbs a laser beam according to claim 3 of this invention, and is fixed, and penetrates a laser beam, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed, irradiates a laser beam at a workpiece, and melts a workpiece an installation base Since the laser radiation section which an installation base and a firmly attached seat member touch, and corresponds with the processing field of a workpiece is formed with the quality of the material which reflects a laser beam It is prevented that an installation base is heated, it can secede from a sheet member easily from an installation base, and becomes possible [offering the laser-beam-machining equipment which can prevent damage on a workpiece].
[0052] Moreover, since it can perform certainly that an installation base reflects a laser beam in claim 3 since the laser radiation section of an installation base is formed with copper, gold, or aluminum, using an YAG laser as a laser beam according to claim 4 of this invention, it can secede from a sheet member easily from an installation base, and it becomes possible to offer the laser-beam-machining equipment which can prevent damage on a workpiece.
[0053] Moreover, the firmly attached seat member which pastes up the workpiece which has the part which absorbs a laser beam according to claim 5 of this invention, and is fixed, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed by vacuum adsorption, irradiates a laser beam at a workpiece, and melts a workpiece Since the hole for

adsorption for carrying out vacuum adsorption of the firmly attached seat member of an installation base is formed in the outside of the processing field of a workpiece Generating of heating from the hole for adsorption is prevented, it can secede from a sheet member easily from an installation base, and it becomes possible to offer the laser-beam-machining equipment which can prevent damage on a workpiece.
[0054] According to claim 6 of this invention, it sets to claim 5. Moreover, the upper part of an installation base Since it is formed in the concave of a reverse trapezoid, the periphery section of a concave pars basilaris ossis occipitalis is equipped with the hole for adsorption, a firmly attached seat member deforms along with the concave of an installation base at the time of vacuum adsorption and vacuum adsorption is carried out on an installation base It becomes possible to offer the laser-beam-machining equipment which can carry out vacuum adsorption of a firmly attached seat member and the installation base certainly.
[0055] Moreover, the firmly attached seat member which pastes up the workpiece which has the part which absorbs a laser beam according to claim 7 of this invention, and is fixed, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed by vacuum adsorption, irradiates a laser beam at a workpiece, and melts a workpiece Since the hole for adsorption was equipped with the pressurization means to which the atmospheric pressure more than atmospheric pressure is applied at the time of balking of the firmly attached seat member from the hole for adsorption and installation base for carrying out vacuum adsorption of the firmly attached seat member of an installation base It becomes possible to offer the laser-beam-machining equipment which can secede from on an installation base from a firmly attached seat member easily.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention] A workpiece can be easily detached and attached from laser-beam-machining equipment, without starting laser-beam-machining equipment for this invention performing chip separation of the semiconductor device of a semi-conductor wafer as a workpiece, and reducing the quality of a workpiece.

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PRIOR ART

[Description of the Prior Art] Conventionally, as the chip separation approach of a semi-conductor wafer, there was a dance cut method by the diamond wheel. This approach is an approach one side sticks a wafer on the sheet-like ingredient which changes with adhesive tape, cuts a little sheet-like ingredient deeply, and cuts a wafer completely. However, by this approach, since there were many rates of the metallic material in the separation section, when the thickness of the separation section was set to 100 micrometers or less, there were metaled weld flash and a trouble that a crack occurred to a wafer.
[0003] As an approach for solving that, the method of performing chip separation of a semi-conductor wafer to JP,8-264491,A in a laser beam is proposed. Drawing 5 R> 5 is drawing showing the chip separation approach of the semiconductor device in JP,8-264491,A. It is based on a Fig. below and the approach of chip separation of a semi-conductor wafer is explained.
[0004] First, when the semi-conductor wafer 3 as a workpiece connected, respectively in the metal section 2 of which between each semiconductor device 1 consists with nickel excellent in absorption of a laser beam is formed as shown in drawing 5 (a) for example, this semi-conductor wafer 3 is pasted up on the adhesion side side of the firmly attached seat member 4 which has an adhesive property on one side, and it fixes (drawing 5 (b)). Next, as shown in drawing 6 , it is held after the stop ring 5 has pulled the perimeter of the firmly attached seat member 4, and the semi-conductor wafer 3 will be in the condition that it is held in the air.
[0005] And this stop ring 5 is being fixed to the body section 6 of laser-beam-machining equipment with the fixed jig 7. Next, a laser beam 8 is irradiated with a desired beam diameter at the metal section 2 of the semi-conductor wafer 3 (drawing 5 (c)). And a dissolution part melts with surface tension, the metal section 2 separates, is carried out [it fuses, and], the dissolution coagulation section 9 is formed, and each semiconductor device 1 is separated (drawing 5 (d)).
[0006] Then, the firmly attached seat member 4 is removed from laser-beam-machining equipment. Next, the firmly attached seat member 4 is pulled and lengthened, and between each separated semiconductor device 1 is extended. If it does in this way, each semiconductor device 1 can be easily removed from the firmly attached seat member 4.
[0007] If each semiconductor device 1 is separated as mentioned above, while irradiating the laser beam 8, the temperature of the semi-conductor wafer 3 rises and the location of elongation and the semi-conductor wafer 3 under processing moves [the firmly attached seat member 4] vertically and horizontally in connection with this. For this reason, focal gap of a laser beam 8 arose during processing, and there was a trouble that process tolerance fell.
[0008] In order to solve this, as shown in drawing 8 , the installation base 11 equipped with many holes 10 for adsorption is formed on the body 6 of laser-beam-machining equipment, and the firmly attached seat member 4 to which the semi-conductor wafer 3 was fixed is laid on this installation base 11. Next, in order to stick the perimeter of the firmly attached seat member 4, and the top face of the installation base 11, it presses down with the fixed jig 12 from on the firmly attached seat member 4.
[0009] Next, opening wide the bulb 15 of the vacuum pump 13 which was open for free passage in the hole 10 for adsorption, and checking with the vacuum gage 14, desired negative pressure is applied from the hole 10 for adsorption with a vacuum pump 13, and the installation base 11 is made to carry out vacuum adsorption of the firmly attached seat member 4. Next, it is processed like the above-mentioned conventional case by the laser beam 8, maintaining this condition (drawing 7 (a)). And a dissolution part melts with surface tension, the metal section 2 separates, is carried out [it fuses, and], the dissolution coagulation section 9 is formed, and each semiconductor device 1 is separated (drawing 7 (b)).

[0010] Then, while stopping a vacuum pump 13, a bulb 15 is closed and it opens wide to atmospheric pressure, and vacuum adsorption is canceled, and the firmly attached seat member 4 is removed from laser-beam-machining equipment. Next, the firmly attached seat member 4 is pulled and lengthened, between each separated semiconductor device 1 is extended, and each semiconductor device 1 is removed from the firmly attached seat member 4.

[0011] If such laser-beam-machining equipment is used, since the solid-state sheet member 4 is fixed on the installation base 11, it is canceled and gap of the firmly attached seat member 4 at the time of the exposure of a laser beam 8 can perform processing excellent in precision.

[0012] Without damaging a laser beam 8, the quality of the material of the installation base 11 used here is excellent in process tolerance, and, generally can consider use of acetal resin from points, such as low cost. However, as shown in drawing 9 , when a laser beam 8 is irradiated, although the permeability of a laser beam 8 penetrates the firmly attached seat member 4 highly, the permeability of a laser beam 8 is inferior in the installation base 11 formed with acetal resin, and it causes absorption of a laser beam 8.

[0013] Then, although melting does not result, temperature rises (for example, the rise to about 100 degrees C can be considered), the firmly attached seat member 4 is also heated by this heating, the firmly attached seat member 4 pastes the installation base 11, and it becomes impossible for the part where the laser beam 8 of the installation base 11 was irradiated to remove the firmly attached seat member 4 easily from laser-beam-machining equipment, and it changes with causes, such as damage on the semi-conductor wafer 3.

[0014] Moreover, in order to perform vacuum adsorption, dust etc. invades in the hole 10 for adsorption formed in the installation base 11, a laser beam 8 is irradiated, is heated by that dust, the firmly attached seat member 4 is heated by this heating, and it is possible to produce the same phenomenon as the above-mentioned case.

[Translation done.]

* NOTICES *

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EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, the firmly attached seat member which changes with the quality of the material which pastes up the workpiece which has the part which absorbs a laser beam according to claim 1 of this invention, and is fixed, and penetrates a laser beam, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed, irradiates a laser beam at a workpiece, and melts a workpiece an installation base Since it is formed with the quality of the material in which an installation base and a firmly attached seat member touch, and the laser radiation section corresponding to the processing field of a workpiece penetrates a laser beam It is prevented that an installation base is heated, it can secede from a sheet member easily from an installation base, and becomes possible [offering the laser-beam-machining equipment which can prevent damage on a workpiece].

[0050] Moreover, since it can perform certainly that an installation base penetrates a laser beam in claim 1 since the laser radiation section of an installation base is formed with glass, using an YAG laser as a laser beam according to claim 2 of this invention, it can secede from a sheet member easily from an installation base, and it becomes possible to offer the laser-beam-machining equipment which can prevent damage on a workpiece.

[0051] Moreover, the firmly attached seat member which becomes with the quality of the material which pastes up the workpiece which has the part which absorbs a laser beam according to claim 3 of this invention, and is fixed, and penetrates a laser beam, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed, irradiates a laser beam at a workpiece, and melts a workpiece an installation base Since the laser radiation section which an installation base and a firmly attached seat member touch, and corresponds with the processing field of a workpiece is formed with the quality of the material which reflects a laser beam It is prevented that an installation base is heated, it can secede from a sheet member easily from an installation base, and becomes possible [offering the laser-beam-machining equipment which can prevent damage on a workpiece].

[0052] Moreover, since it can perform certainly that an installation base reflects a laser beam in claim 3 since the laser radiation section of an installation base is formed with copper, gold, or aluminum, using an YAG laser as a laser beam according to claim 4 of this invention, it can secede from a sheet member easily from an installation base, and it becomes possible to offer the laser-beam-machining equipment which can prevent damage on a workpiece.

[0053] Moreover, the firmly attached seat member which pastes up the workpiece which has the part which absorbs a laser beam according to claim 5 of this invention, and is fixed, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed by vacuum adsorption, irradiates a laser beam at a workpiece, and melts a workpiece Since the hole for adsorption for carrying out vacuum adsorption of the firmly attached seat member of an installation base is formed in the outside of the processing field of a workpiece Generating of heating from the hole for adsorption is prevented, it can secede from a sheet member easily from an installation base, and it becomes possible to offer the laser-beam-machining equipment which can prevent damage on a workpiece.

[0054] According to claim 6 of this invention, it sets to claim 5. Moreover, the upper part of an installation base Since it is formed in the concave of a reverse trapezoid, the periphery section of a concave pars basilaris ossis occipitalis is equipped with the hole for adsorption, a firmly attached seat member deforms along with the concave of an installation base at the time of vacuum adsorption and vacuum adsorption is carried out on an installation base It becomes possible to offer the laser-beam-machining equipment which can carry out vacuum adsorption of a firmly attached seat member and the installation base certainly.

[0055] Moreover, the firmly attached seat member which pastes up the workpiece which has the part which absorbs a laser beam according to claim 7 of this invention, and is fixed, In the laser-beam-machining equipment which is equipped with the installation base which lays a firmly attached seat member and is fixed by vacuum adsorption, irradiates a laser beam at a workpiece, and melts a workpiece Since the hole for adsorption was equipped with the pressurization means to which the atmospheric pressure more than atmospheric pressure is applied at the time of balking of the firmly attached seat member from the hole for adsorption and installation base for carrying out vacuum adsorption of the firmly attached seat member of an installation base It becomes possible to offer the laser-beam-machining equipment which can secede from on an installation base from a firmly attached seat member easily.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] When it was constituted as mentioned above, the firmly attached seat member 4 pasted the installation base 11 and conventional laser-beam-machining equipment removed the semi-conductor wafer 3 of a workpiece from laser-beam-machining equipment, the semi-conductor wafer 3 was damaged and it had the trouble that quality deteriorated. Moreover, when the firmly attached seat member 4 was fixed on the installation base 11 by vacuum adsorption, since the whole surface of the firmly attached seat member 4 touched on the installation base 11, balking of the firmly attached seat member 4 became difficult from the installation base 11, and after vacuum disconnection damaged the semi-conductor wafer 3, and had the trouble that quality deteriorated.
[0016] This invention aims at offering the laser-beam-machining equipment which can detach and attach a workpiece easily, without having been made in order to cancel the above troubles, and reducing the quality of a workpiece.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the configuration of the laser-beam-machining equipment by the gestalt 1 of implementation of this invention.
[Drawing 2] It is drawing showing the processing approach of the laser-beam-machining equipment shown in drawing 1 .
[Drawing 3] It is drawing showing the processing approach of the laser-beam-machining equipment by the gestalt 2 of implementation of this invention.
[Drawing 4] It is drawing showing the configuration of the laser-beam-machining equipment by the gestalt 3 of implementation of this invention.
[Drawing 5] It is drawing showing the processing approach of conventional laser-beam-machining equipment.
[Drawing 6] It is drawing showing the configuration of the conventional laser-beam-machining equipment used in drawing 5 .
[Drawing 7] It is drawing showing the processing approach of other conventional laser-beam-machining equipments.
[Drawing 8] It is drawing showing the configuration of the conventional laser-beam-machining equipment used in drawing 7 .
[Drawing 9] It is drawing for explaining the trouble of other conventional laser-beam-machining equipments.
[Description of Notations]
16 Body, 17, 33, 34 Installation Base, 18 Firmly Attached Seat Member, 19 A semi-conductor wafer, 20 A stop ring, 21 22 A fixed jig, 35 The hole for adsorption, 23 A vacuum pump, 24 The 1st bulb, 25 A vacuum gage, 26 A pressurization means, 27 The 2nd bulb, 28 A semiconductor device, 29 The metal section, 30 A laser beam, 31 The dissolution coagulation section, 32 A laser beam, 32a The reflected light, 34a Reverse trapezoid crevice.

[Translation done.]

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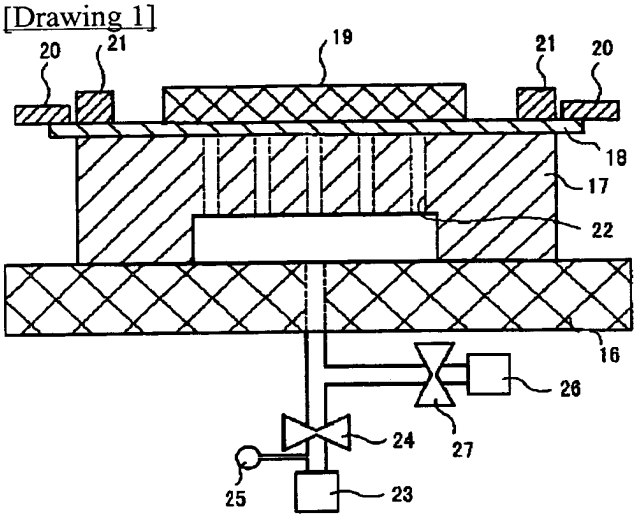
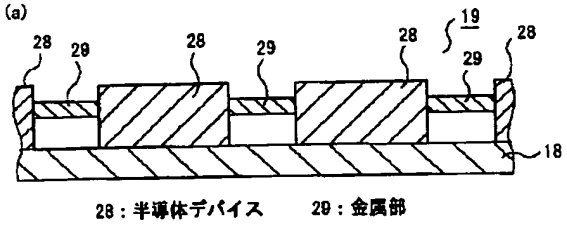
DRAWINGS

[Drawing 1]

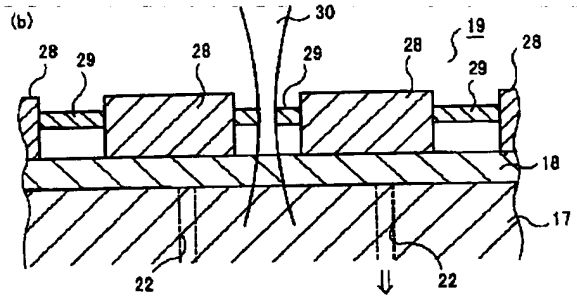


16：本体
17：載置台
18：固定シート部材
19：半導体ウエハ
20：固定リング
21：固定治具
22：吸着用穴
23：真空ポンプ
24：第１のバルブ
25：真空ゲージ
26：加圧手段
27：第２のバルブ

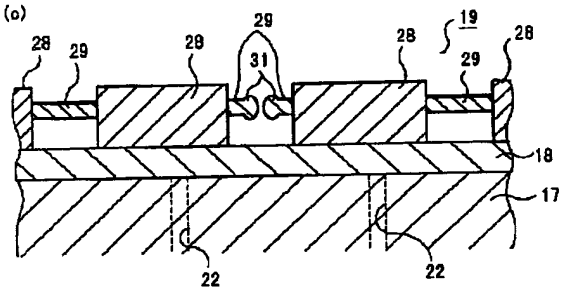
[Drawing 2]



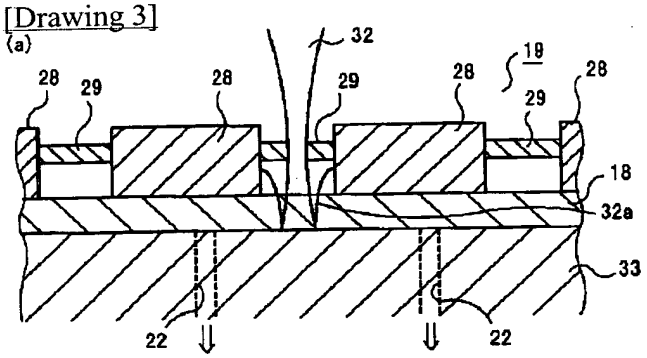
28：半導体デバイス　29：金属部



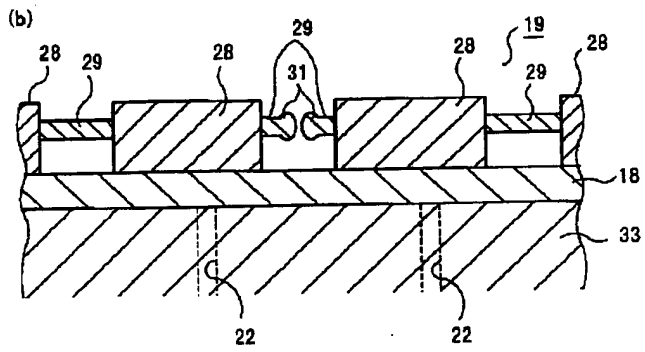
30：レーザ光　31：溶解凝固部



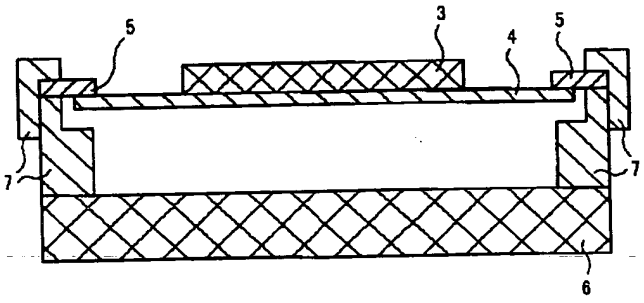
[Drawing 3]



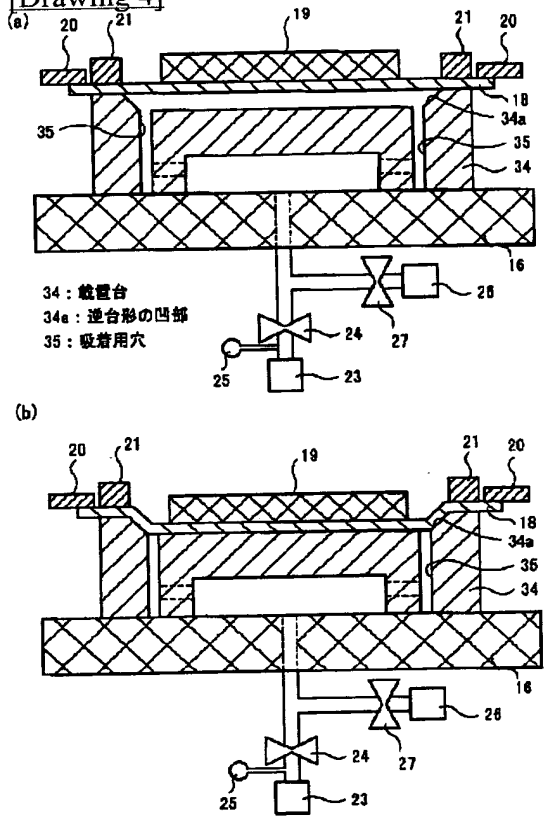
32：レーザ光
32a：反射光
33：載置台



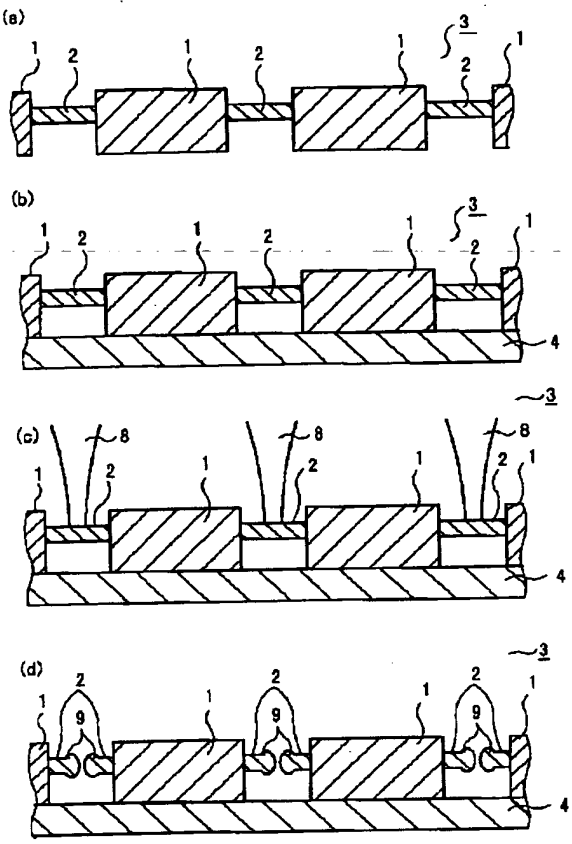
[Drawing 6]



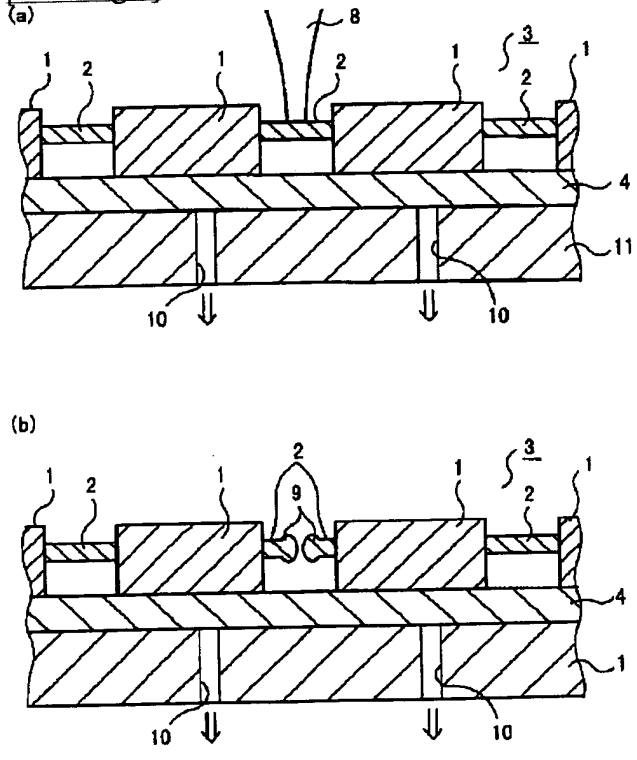
[Drawing 4]



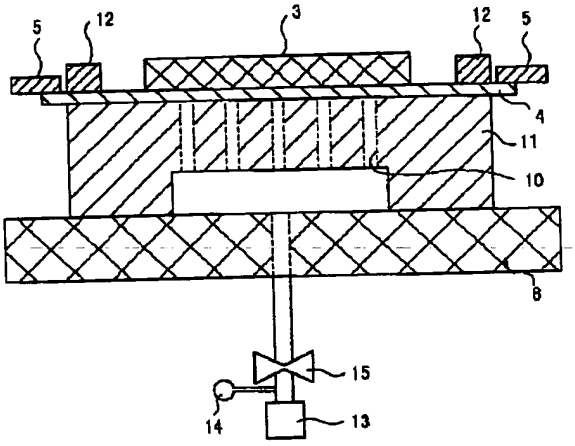
[Drawing 5]



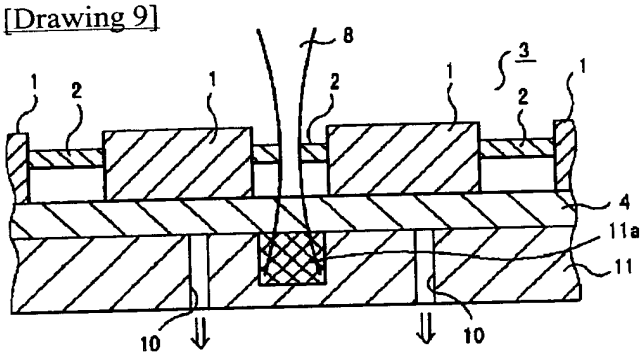
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]

Citation 3

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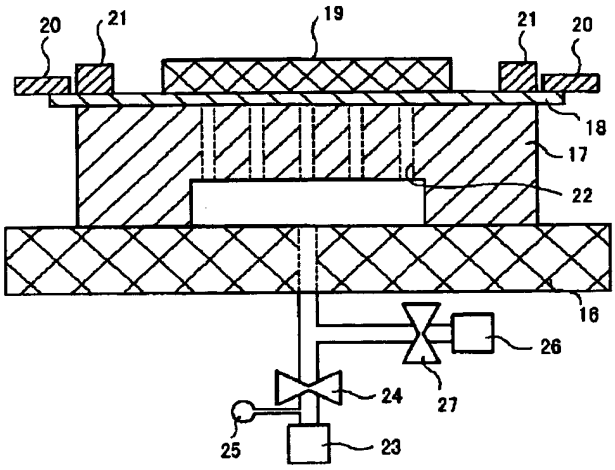
最終頁に続く

(54)【発明の名称】　レーザ加工装置

(57)【要約】
【課題】　被加工物の品質を低下させることなく、被加工物をレーザ加工装置から容易に着脱することができるレーザ加工装置を得ることを目的とする。
【解決手段】　レーザ光３０を吸収する部分を有する半導体ウエハ１９を接着して固定し、かつ、レーザ光３０を透過する材質にて成る固定シート部材１８と、固定シート部材１８を載置して固定する載置台１７とを備え、半導体ウエハ１９にレーザ光３０を照射して被加工物を溶断するレーザ加工装置において、載置台１７は、レーザ光３０を透過する材質にて形成されている。



16：本体
17：載置台
18：固定シート部材
19：半導体ウエハ
20：固定リング
21：固定治具
22：吸着用穴
23：真空ポンプ
24：第１のバルブ
25：真空ゲージ
26：加圧手段
27：第２のバルブ

1

【特許請求の範囲】

【請求項１】　レーザ光を吸収する部分を有する被加工物を接着して固定し、かつ、上記レーザ光を透過する材質にて成る固定シート部材と、上記固定シート部材を載置して固定する載置台とを備え、上記被加工物に上記レーザ光を照射して上記被加工物を溶断するレーザ加工装置において、上記載置台は、上記載置台と上記固定シート部材とが接し、かつ、上記被加工物の加工領域に対応するレーザ照射部が、上記レーザ光を透過する材質にて形成されていることを特徴とするレーザ加工装置。

【請求項２】　レーザ光としてＹＡＧレーザを用い、載置台のレーザ照射部がガラスにて形成されていることを特徴とする請求項１に記載のレーザ加工装置。

【請求項３】　レーザ光を吸収する部分を有する被加工物を接着して固定し、かつ、上記レーザ光を透過する材質にて成る固定シート部材と、上記固定シート部材を載置して固定する載置台とを備え、上記被加工物に上記レーザ光を照射して上記被加工物を溶断するレーザ加工装置において、上記載置台は、上記載置台と上記固定シート部材とが接し、かつ、上記被加工物の加工領域と対応するレーザ照射部が、上記レーザ光を反射する材質にて形成されていることを特徴とするレーザ加工装置。

【請求項４】　レーザ光としてＹＡＧレーザを用い、載置台のレーザ照射部が銅、または、金、または、アルミニウムにて形成されていることを特徴とする請求項３に記載のレーザ加工装置。

【請求項５】　レーザ光を吸収する部分を有する被加工物を接着して固定する固定シート部材と、上記固定シート部材を載置して真空吸着にて固定する載置台とを備え、上記被加工物に上記レーザ光を照射して上記被加工物を溶断するレーザ加工装置において、上記載置台の上記固定シート部材を真空吸着するための吸着用穴が、上記被加工物の加工領域の外側に形成されていることを特徴とするレーザ加工装置。

【請求項６】　載置台の上部は、逆台形の凹状にて形成され、吸着用穴を上記凹状の底部の周縁部に備え、真空吸着時に、固定シート部材が上記載置台の凹状に沿って変形して上記載置台上に真空吸着されることを特徴とする請求項５に記載のレーザ加工装置。

【請求項７】　レーザ光を吸収する部分を有する被加工物を接着して固定する固定シート部材と、上記固定シート部材を載置して真空吸着にて固定する載置台とを備え、上記被加工物に上記レーザ光を照射して上記被加工物を溶断するレーザ加工装置において、上記載置台の上記固定シート部材を真空吸着するための吸着用穴と、上記載置台からの上記固定シート部材の離脱時に、上記吸着用穴に大気圧以上の気圧をかける加圧手段を備えたことを特徴とするレーザ加工装置。

【発明の詳細な説明】

【０００１】

2

【発明の属する技術分野】この発明は、例えば被加工物として半導体ウエハの半導体デバイスのチップ分離を行うためのレーザ加工装置に係り、被加工物の品質を低下させることなく、被加工物をレーザ加工装置から容易に着脱することができるものである。

【０００２】

【従来の技術】従来、半導体ウエハのチップ分離方法としては、ダイアモンドホイールによるダンシングカット方式があった。この方法は、片面が粘着テープで成るシート状材料にウエハを貼り付け、シート状材料を少し切り込んで、ウエハを完全に切断する方法である。しかし、この方法では、分離部での金属材料の割合が多いため、分離部の厚みが１００μｍ以下となると、金属のバリや、ウエハにクラックが発生するという問題点があった。

【０００３】そのことを解決するための方法として、例えば特開平８－２６４４９１号公報にレーザ光にて半導体ウエハのチップ分離を行う方法が提案されている。図５は特開平８－２６４４９１号公報における半導体デバイスのチップ分離方法を示す図である。以下図に基づいて、半導体ウエハのチップ分離の方法を説明する。

【０００４】まず、図５（ａ）に示すように、例えば各半導体デバイス１間が、レーザ光の吸収に優れたニッケルにて成る金属部２にて、それぞれ接続された被加工物としての半導体ウエハ３が形成されている場合、この半導体ウエハ３を、片面に接着性を有する固定シート部材４の接着面側に接着させて固定する（図５（ｂ））。次に、図６に示すように、固定リング５にて、固定シート部材４の周囲を引っ張った状態にて保持され、半導体ウエハ３は空中に保持されるような状態となる。

【０００５】そして、この固定リング５はレーザ加工装置の本体部６に、固定冶具７にて固定されている。次に、半導体ウエハ３の金属部２に所望のビーム径にてレーザ光８を照射する（図５（ｃ））。そして、金属部２は溶融し、表面張力により溶解箇所が溶け別れして、溶解凝固部９が形成され、各半導体デバイス１は分離される（図５（ｄ））。

【０００６】その後、固定シート部材４をレーザ加工装置から取り外す。次に、固定シート部材４を引っ張って伸ばし、分離された各半導体デバイス１間を広げる。このようにすれば、各半導体デバイス１を固定シート部材４から容易に取り外すことができる。

【０００７】上記のようにして各半導体デバイス１を分離すると、レーザ光８を照射している間に、半導体ウエハ３の温度が上昇し、これにともない固定シート部材４が伸び、加工中の半導体ウエハ３の位置が上下左右に移動する。このため、加工中にレーザ光８の焦点ズレが生じてしまい、加工精度が低下するという問題点があった。

【０００８】このことを解決するために、図８に示すよ

うに、レーザ加工装置の本体６上に、吸着用穴１０を多数備えた載置台１１を設け、この載置台１１上に、半導体ウエハ３が固定された固定シート部材４を載置する。次に、固定シート部材４の周囲と載置台１１の上面とを密着させるため、固定シート部材４上から固定冶具１２にて押さえつける。

【０００９】次に、吸着用穴１０に連通した真空ポンプ１３のバルブ１５を開放して、真空ゲージ１４にて確認しながら、真空ポンプ１３にて吸着用穴１０から所望の負圧をかけ、載置台１１に固定シート部材４を真空吸着させる。次にこの状態を保ちながら、レーザ光８にて上記従来の場合と同様に加工を行う（図７（ａ））。そして、金属部２は溶融し、表面張力により溶解箇所が溶け別れして、溶解凝固部９が形成され、各半導体デバイス１は分離される（図７（ｂ））。

【００１０】その後、真空ポンプ１３を止めるとともにバルブ１５を閉じ大気圧まで開放し、真空吸着を解除して、固定シート部材４をレーザ加工装置から取り外す。次に、固定シート部材４を引っ張って伸ばし、分離された各半導体デバイス１間を広げて、各半導体デバイス１を固定シート部材４から取り外す。

【００１１】このようなレーザ加工装置を用いれば、固体シート部材４は載置台１１上に固定されるため、レーザ光８の照射時の固定シート部材４のズレは解消され、精度に優れた加工を行うことができる。

【００１２】ここで使用される載置台１１の材質は、レーザ光８に損傷されることなく、加工精度に優れ、低コストなどの点から、一般的にアセタール樹脂の使用が考えられる。しかし、図９に示すように、レーザ光８を照射した場合、固定シート部材４はレーザ光８の透過率が高く透過するものの、アセタール樹脂にて形成された載置台１１はレーザ光８の透過率が劣り、レーザ光８の吸収をおこす。

【００１３】すると、載置台１１のレーザ光８が照射された箇所は、溶融までは至らないものの、温度が上昇し（例えば１００℃程度までの上昇が考えられる）、この加熱により固定シート部材４も加熱され、載置台１１に固定シート部材４が接着してしまい、固定シート部材４をレーザ加工装置から容易に外せなくなり、半導体ウエハ３の損傷などの原因と成る。

【００１４】また、真空吸着を行うために、載置台１１に形成された吸着用穴１０内にゴミなどが侵入し、そのゴミにレーザ光８が照射され、加熱されて、この加熱により固定シート部材４が加熱され、上記場合と同様の現象を生じることが考えられる。

【００１５】

【発明が解決しようとする課題】従来のレーザ加工装置は上記のように構成され、載置台１１に固定シート部材４が接着してしまい、レーザ加工装置から被加工物の半導体ウエハ３を取り外す際に、半導体ウエハ３が損傷し

品質が低下するという問題点があった。又、真空吸着にて載置台１１上に固定シート部材４を固定すると、真空開放後も載置台１１上に固定シート部材４の全面が接触しているため、載置台１１から固定シート部材４の離脱が困難となり、半導体ウエハ３を損傷してしまい品質が低下するという問題点があった。

【００１６】この発明は上記のような問題点を解消するためなされたもので、被加工物の品質を低下させることなく、被加工物を容易に着脱することができるレーザ加工装置を提供することを目的とする。

【００１７】

【課題を解決するための手段】この発明に係る請求項１のレーザ加工装置は、レーザ光を吸収する部分を有する被加工物を接着して固定し、かつ、レーザ光を透過する材質にて成る固定シート部材と、固定シート部材を載置して固定する載置台とを備え、被加工物にレーザ光を照射して被加工物を溶断するレーザ加工装置において、載置台は、載置台と固定シート部材とが接し、かつ、被加工物の加工領域に対応するレーザ照射部が、レーザ光を透過する材質にて形成されているものである。

【００１８】また、この発明に係る請求項２のレーザ加工装置は、請求項１において、レーザ光としてＹＡＧレーザを用い、載置台のレーザ照射部がガラスにて形成されているものである。

【００１９】また、この発明に係る請求項３のレーザ加工装置は、レーザ光を吸収する部分を有する被加工物を接着して固定し、かつ、レーザ光を透過する材質にて成る固定シート部材と、固定シート部材を載置して固定する載置台とを備え、被加工物にレーザ光を照射して被加工物を溶断するレーザ加工装置において、載置台は、載置台と固定シート部材とが接し、かつ、被加工物の加工領域と対応するレーザ照射部が、レーザ光を反射する材質にて形成されているものである。

【００２０】また、この発明に係る請求項４のレーザ加工装置は、請求項３において、レーザ光としてＹＡＧレーザを用い、載置台のレーザ照射部が銅、または、金、または、アルミニウムにて形成されているものである。

【００２１】また、この発明に係る請求項５のレーザ加工装置は、レーザ光を吸収する部分を有する被加工物を接着して固定する固定シート部材と、固定シート部材を載置して真空吸着にて固定する載置台とを備え、被加工物にレーザ光を照射して被加工物を溶断するレーザ加工装置において、載置台の固定シート部材を真空吸着するための吸着用穴が、被加工物の加工領域の外側に形成されているものである。

【００２２】また、この発明に係る請求項６のレーザ加工装置は、請求項５において、載置台の上部は、逆台形の凹状にて形成され、吸着用穴を凹状の底部の周縁部に備え、真空吸着時に、固定シート部材が載置台の凹状に沿って変形して載置台上に真空吸着されるものである。

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【００２３】また、この発明に係る請求項７のレーザ加工装置は、レーザ光を吸収する部分を有する被加工物を接着して固定する固定シート部材と、固定シート部材を載置して真空吸着にて固定する載置台とを備え、被加工物にレーザ光を照射して被加工物を溶断するレーザ加工装置において、載置台の固定シート部材を真空吸着するための吸着用穴と、載置台からの固定シート部材の離脱時に、吸着用穴に大気圧以上の気圧をかける加圧手段を備えたものである。

【００２４】

【発明の実施の形態】実施の形態１．以下、この発明の実施の形態について説明する。図１はこの発明の実施の形態１のレーザ加工装置の構成を示す図、図２は図１に示したレーザ加工装置を用いた加工方法を説明するための図である。図１において、１６はレーザ加工装置の本体、１７はこの本体１６上に形成された載置台で、レーザ光を透過する材質にて形成されている。

【００２５】１８はレーザ光を吸収する箇所を有する被加工物としての半導体ウエハ１９を接着して固定する固定シート部材で、片面が接着層にて形成され、レーザ光を透過する材質にて成る。２０は固定シート部材１８の周囲を引っ張った状態にて保持するための固定リング、２１は固定シート部材１８と載置台１７の上面とを密着させるための固定冶具、２２は載置台１７に多数設けられた吸着用穴で、載置台１７と固定シート部材１８との真空吸着を行うためのものである。

【００２６】２３は吸着用穴２２に連通する真空ポンプ、２４はこの真空ポンプ２３の開閉を行うための第１のバルブ、２５は真空ポンプ２３による負圧を確認するための真空ゲージ、２６は吸着用穴２２に連通され、例えばこの吸着穴２２に乾燥エアーを供給することにより、大気圧以上の気圧をかける加圧手段、２７はこの加圧手段２６の開閉を行うための第２のバルブである。

【００２７】図２において、２８は半導体デバイス、２９は各半導体デバイス２８間にて接続されている、レーザ光を吸収する部分であり、例えばレーザ光の吸収に優れたニッケルにて成る金属部、これら半導体デバイス２８および金属部２９により被加工物としての半導体ウエハ１９は構成されている。３０は被加工物を加工するためのレーザ光である。ここではレーザ光３０としてＹＡＧレーザ（波長が１．０６μｍのもの）を、載置台１７としてＹＡＧレーザの透過性に優れた石英ガラスをそれぞれ用いることとする。

【００２８】次に上記のように構成された実施の形態１のレーザ加工装置の加工方法について説明する。まず、従来の場合と同様に、半導体ウエハ１９を固定シート部材１８に接着させて固定する（図２（ａ））。次に、固定シート部材１８を載置台１７上に載置する。次に、固定リング２０にて、固定シート部材１８の周囲を引っ張った状態にて保持する。

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【００２９】次に、固定シート部材１８の周囲の上面から固定冶具２１にて押さえつけ、固定シート部材１８の周囲と載置台１７の上面とを密着させる。次に、第１のバルブ２４を開放して真空ポンプ２３を作動させ、真空ゲージ２５にて確認しながら、吸着用穴２２から所望の負圧をかけ、載置台１７に固定シート部材１８を真空吸着させる。

【００３０】次に、この状態を保ちながら、半導体ウエハ１９の金属部２９に所望のビーム径にてレーザ光３０を照射する（図２（ｂ））。この際、固定シート部材１８および載置台１７にはレーザ光３０が照射されるものの、固定シート部材１８および載置台１７はレーザ光３０を透過するため、温度が上昇することはなく、互いに接着することはない。

【００３１】そして、金属部２９はレーザ光３０を吸収して温度が上昇して溶融され、表面張力により溶解箇所が溶け別れして、溶解凝固部３１が形成され、各半導体デバイス２８は分離される（図２（ｃ））。次に、第１のバルブ２４を閉じるとともに、真空ポンプ２３の動作を停止する。次に、第２のバルブ２６を開放し、吸着用穴２２に加圧手段２６から乾燥エアーを供給して、大気圧以上の圧力（例えば、１．５気圧程度が想定される）をかける。そして、固定シート部材１８を載置台１７から自動的に離脱させる。

【００３２】次に、固定シート部材１８を引っ張って伸ばし、分離された各半導体デバイス２８間を広げ、各半導体デバイス２８を固定シート部材１８から取り外す。

【００３３】上記のように形成された実施の形態１のレーザ加工装置によれば、レーザ加工時に、固定シート部材１８および載置台１７はレーザ光３０を透過し、これらの温度がほとんど上昇しないため、固定シート部材１８と載置台１７とが接着することがない。よって、加工後に、半導体ウエハ１９に損傷を与えることなく、固定シート部材１８をレーザ加工装置から容易に離脱することができる。

【００３４】また、その離脱の際に、吸着用穴２２から大気圧以上の圧力をかけることにより、自動的に固定シート部材１８は載置台１７から離脱するため、固定シート部材１８をレーザ加工装置からより一層容易に離脱させることができる。

【００３５】尚、上記実施の形態１においては、載置台１７の全てをレーザ光の透過性を有する材質にて形成する例を示したがこれに限れることはなく、少なくとも載置台１７のうち、載置台１７と固定シート部材１８とが接し、かつ、半導体ウエハ１９の加工領域に対応するレーザ照射部が、レーザ光３０を透過する材質にて形成されていれば、上記実施の形態１と同様の効果を奏することは言うまでもなく、例えばガラスなど高価な材質を利用する場合、必要な領域のみガラスにて形成するようにすれば、コストを削減することができる。

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【００３６】実施の形態２．上記実施の形態１では、載置台１７がレーザ光３０を透過する材質にて形成される例を示したが、載置台を、レーザ光を反射する材質にて形成するようにしても、上記実施の形態１と同様の効果を奏することができる。

【００３７】図３はこの発明の実施の形態２におけるレーザ加工装置の一部とその加工方法を示した図である。図において、上記実施の形態１と同様の部分は同一符号を付して説明を省略する。３２は被加工物としての半導体ウエハ１９を加工するためのレーザ光、３３は固定シート部材１８を載置するための載置台で、レーザ光を反射する材質にて形成されている。３２ａは載置台３３上にてレーザ光３２が反射した反射光である。ここでは、レーザ光３２としてＹＡＧレーザを、載置台３３はＹＡＧレーザの反射に優れた銅、または、金、または、アルミニウムにて形成するものとする。

【００３８】次に上記のように構成された実施の形態２のレーザ加工装置の加工方法について説明する。まず、上記実施の形態１と同様に、固定シート部材１８を載置台３３に真空吸着させた後、図３（ａ）に示したように、半導体ウエハ１９の金属部２９に所望のビーム径にてレーザ光３２を照射する。この際、固定シート部材１８および載置台３３にはレーザ光３０が照射されるものの、固定シート部材１８はレーザ光３２を透過し、載置台３３上ではレーザ光３２が反射し、反射光３２ａと成り、レーザ光３２を吸収しない。よって、これらの温度が上昇することはほとんどなく、互いに接着するのは防止される。

【００３９】以後、上記実施の形態１と同様の方法にて行い、金属部２９はレーザ光３２を吸収して温度が上昇して溶解され、溶解凝固部３１が形成され、各半導体デバイス２８は分離される（図３（ｂ））。そして、固定シート部材１８を載置台３３から離脱し、固定シート部材１８から各半導体デバイス２８を取り外す。

【００４０】上記のように構成された実施の形態２によれば、上記実施の形態１と同様の効果を奏するのはもちろんのこと、載置台３３をレーザ光３２が反射する材質にて形成すればよく、銅または金またはアルミニウムなどはガラスと比較して加工を行いやすく、かつ、破損の心配が少なくなる。

【００４１】尚、上記実施の形態２においては、載置台３３の全てがレーザ光３２を反射する材質にて形成される例を示したがこれに限られることはなく、少なくとも載置台３３のうち、載置台３３と固定シート部材１８とが接し、かつ、半導体ウエハ１９の加工領域に対応するレーザ照射部が、レーザ光３２を反射する材質にて形成されていれば、上記実施の形態２と同様の効果を奏することは言うまでもなく、例えば載置台３３の表面のみが、レーザ光３２を反射する材質にて成る場合などが考えられる。

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【００４２】実施の形態３．図４はこの発明における実施の形態３のレーザ加工装置の構成および加工工程を示す図である。図において、上記各実施の形態と同様の部分は同一符号を付して説明を省略する。３４は固定シート部材１８を載置して真空吸着にて固定する載置台で、例えば、レーザ光を透過する材質、または、レーザ光を反射する材質にて形成されることが考えられる。３４ａは載置台３４の上部に形成された、逆台形の凹部、３５は半導体ウエハ１９の加工領域の外側に形成されるとともに、逆台形の凹部３４ａの底部の周縁部に形成された吸着用穴である。

【００４３】次に上記のように構成された実施の形態３のレーザ加工装置の加工工程について説明する。まず、上記各実施の形態と同様に、固定シート部材１８を載置台３４上に載置する（図４（ａ））。次に、第１のバルブ２４を開放して真空ポンプ２３を作動させ、真空ゲージ２５にて確認しながら、吸着用穴３５から所望の負圧をかけ、載置台３４に固定シート部材１８を真空吸着させる（図４（ｂ））。この際、図４（ｂ）からも明らかなように、固定シート部材１８は載置台３４の上面の逆台形の凹部３４ａの形状に変形して吸着されている。

【００４４】このように、載置台３４の吸着用穴３５より内側が、吸着用穴３６より外側より低く形成されているため、真空吸着の際に、載置台３４の半導体ウエハ１９の加工領域の外側に吸着用穴３５が形成されていても、載置台３４と固定シート部材１８との間に気泡が残ることなく真空吸着を行うことができる。

【００４５】次に、上記各実施の形態と同様に、レーザ光にて半導体ウエハ１９の加工を行う。この際、吸着用穴３５は半導体ウエハ１９の加工領域の外側に形成されているため、吸着用穴３５にレーザ光が照射されることはない。よって、吸着用穴３５内にゴミなどが存在しても、加熱されることはない。

【００４６】次に、第１のバルブ２４を閉じるとともに、真空ポンプ２３の動作を停止する（図４（ａ））。すると、固定シート部材１８は載置台３４の逆台形の凹部３４ａから離れ、元の状態にもどる。そして、上記各実施の形態と同様に、固定シート部材１８を載置台３４から離脱し、固定シート部材１８から半導体ウエハ１９を取り外す。

【００４７】上記のように構成された実施の形態３によれば、上記各実施の形態と同様の効果を奏するのはもちろんのこと、吸着用穴３５内のゴミなどによる加熱が防止され、固定シート部材１８が加熱されることによる不具合を解消することができる。

【００４８】尚、上記各実施の形態において、被加工物として半導体ウエハを用いる例を示したがこれに限られることはなく、レーザ光を吸収する部分を有する被加工物であればよいことは言うまでもなく、特に微細な加工を要求されるものに優れた効果を有するものである。ま

た、半導体ウエハの半導体デバイス間を切断する例を示したがこれに限られることはなく、例えば穴あけ加工など、レーザ光による溶断を利用する加工であればよいことは言うまでもなく、同様の効果を奏するものである。又、載置台と固定シート部材との真空吸着による離脱を、吸着用穴に大気圧以上の気圧をかけ、載置台から固定シート部材を浮かせるようにして離脱すれば、被加工物への損傷を防止することができる。

【００４９】

【発明の効果】以上のように、この発明の請求項１によれば、レーザ光を吸収する部分を有する被加工物を接着して固定し、かつ、レーザ光を透過する材質にて成る固定シート部材と、固定シート部材を載置して固定する載置台とを備え、被加工物にレーザ光を照射して被加工物を溶断するレーザ加工装置において、載置台は、載置台と固定シート部材とが接し、かつ、被加工物の加工領域に対応するレーザ照射部が、レーザ光を透過する材質にて形成されているので、載置台が加熱されることが防止され、シート部材を載置台から容易に離脱でき、被加工物の損傷を防止することができるレーザ加工装置を提供することが可能となる。

【００５０】また、この発明の請求項２によれば、請求項１において、レーザ光としてＹＡＧレーザを用い、載置台のレーザ照射部がガラスにて形成されているので、載置台がレーザ光を透過することが確実にできるので、シート部材を載置台から容易に離脱でき、被加工物の損傷を防止することができるレーザ加工装置を提供することが可能となる。

【００５１】また、この発明の請求項３によれば、レーザ光を吸収する部分を有する被加工物を接着して固定し、かつ、レーザ光を透過する材質にてなる固定シート部材と、固定シート部材を載置して固定する載置台とを備え、被加工物にレーザ光を照射して被加工物を溶断するレーザ加工装置において、載置台は、載置台と固定シート部材とが接し、かつ、被加工物の加工領域と対応するレーザ照射部が、レーザ光を反射する材質にて形成されているので、載置台が加熱されることが防止され、シート部材を載置台から容易に離脱でき、被加工物の損傷を防止することができるレーザ加工装置を提供することが可能となる。

【００５２】また、この発明の請求項４によれば、請求項３において、レーザ光としてＹＡＧレーザを用い、載置台のレーザ照射部が銅、または、金、または、アルミニウムにて形成されているので、載置台がレーザ光を反射することが確実にできるので、シート部材を載置台から容易に離脱でき、被加工物の損傷を防止することができるレーザ加工装置を提供することが可能となる。

【００５３】また、この発明の請求項５によれば、レーザ光を吸収する部分を有する被加工物を接着して固定する固定シート部材と、固定シート部材を載置して真空吸着にて固定する載置台とを備え、被加工物にレーザ光を照射して被加工物を溶断するレーザ加工装置において、載置台の固定シート部材を真空吸着するための吸着用穴が、被加工物の加工領域の外側に形成されているので、吸着用穴からの加熱の発生が防止され、シート部材を載置台から容易に離脱でき、被加工物の損傷を防止することができるレーザ加工装置を提供することが可能となる。

【００５４】また、この発明の請求項６によれば、請求項５において、載置台の上部は、逆台形の凹状にて形成され、吸着用穴を凹状の底部の周縁部に備え、真空吸着時に、固定シート部材が載置台の凹状に沿って変形して載置台上に真空吸着されるので、固定シート部材と載置台とを確実に真空吸着することができるレーザ加工装置を提供することが可能となる。

【００５５】また、この発明の請求項７によれば、レーザ光を吸収する部分を有する被加工物を接着して固定する固定シート部材と、固定シート部材を載置して真空吸着にて固定する載置台とを備え、被加工物にレーザ光を照射して被加工物を溶断するレーザ加工装置において、載置台の固定シート部材を真空吸着するための吸着用穴と、載置台からの固定シート部材の離脱時に、吸着用穴に大気圧以上の気圧をかける加圧手段を備えたので、固定シート部材を容易に載置台上から離脱することができるレーザ加工装置を提供することが可能となる。

【図面の簡単な説明】

【図１】　この発明の実施の形態１によるレーザ加工装置の構成を示す図である。

【図２】　図１に示したレーザ加工装置の加工方法を示す図である。

【図３】　この発明の実施の形態２によるレーザ加工装置の加工方法を示す図である。

【図４】　この発明の実施の形態３によるレーザ加工装置の構成を示す図である。

【図５】　従来のレーザ加工装置の加工方法を示す図である。

【図６】　図５にて使用される従来のレーザ加工装置の構成を示す図である。

【図７】　他の従来のレーザ加工装置の加工方法を示す図である。

【図８】　図７にて使用される従来のレーザ加工装置の構成を示す図である。

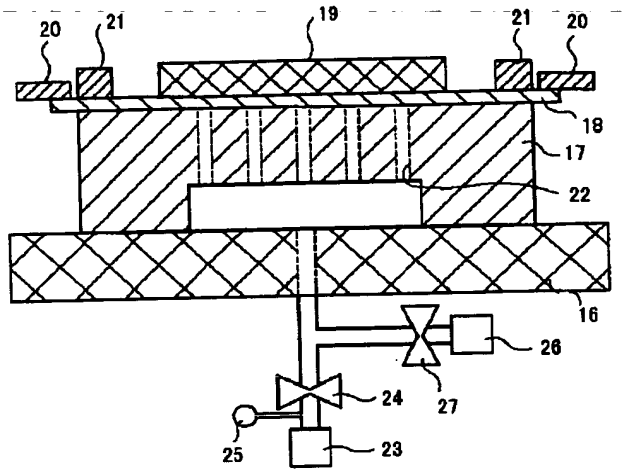
【図９】　他の従来のレーザ加工装置の問題点を説明するための図である。

【符号の説明】

１６　本体、１７，３３，３４　載置台、１８　固定シート部材、１９　半導体ウエハ、２０　固定リング、２１　固定治具、２２，３５　吸着用穴、２３　真空ポンプ、２４　第１のバルブ、２５　真空ゲージ、２６　加圧手段、２７　第２のバルブ、２８　半導体デバイス、

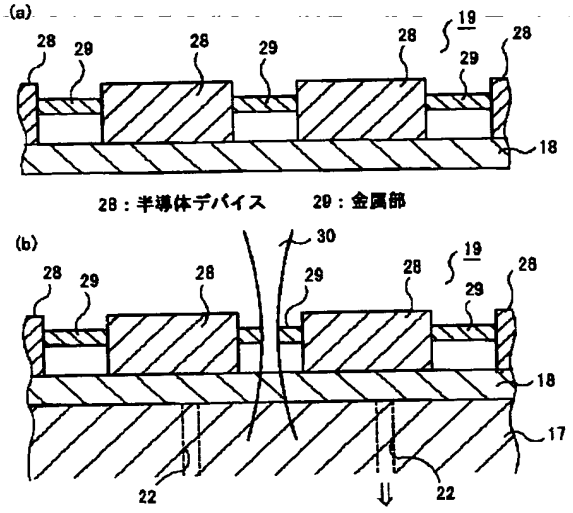
２９　金属部、３０　レーザ光、３１　溶解凝固部、３２　レーザ光、３２ａ　反射光、３４ａ　逆台形の凹部。

【図１】

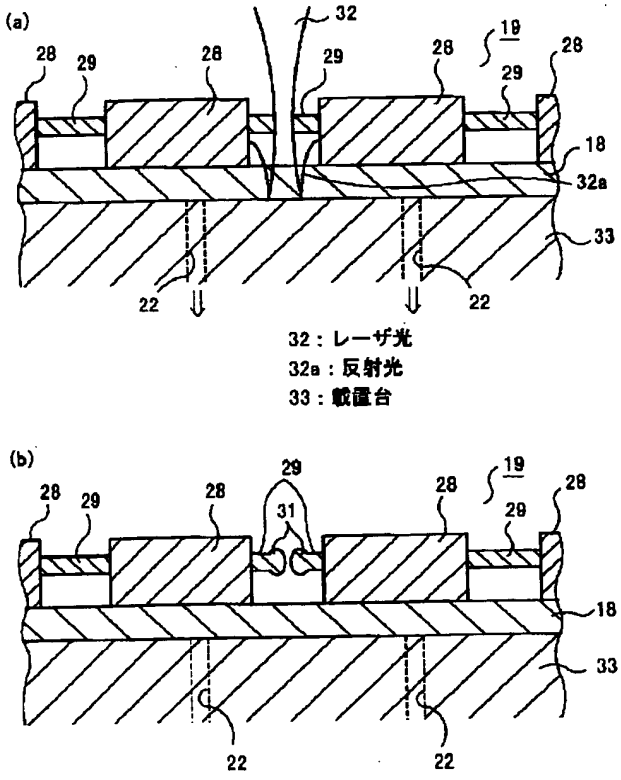


16：本体
17：載置台
18：固定シート部材
19：半導体ウエハ
20：固定リング
21：固定治具
22：吸着用穴
23：真空ポンプ
24：第１のバルブ
25：真空ゲージ
26：加圧手段
27：第２のバルブ

【図２】

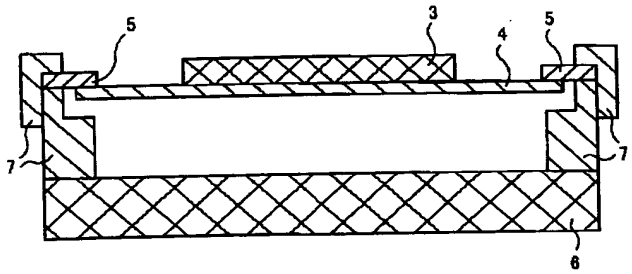


【図３】

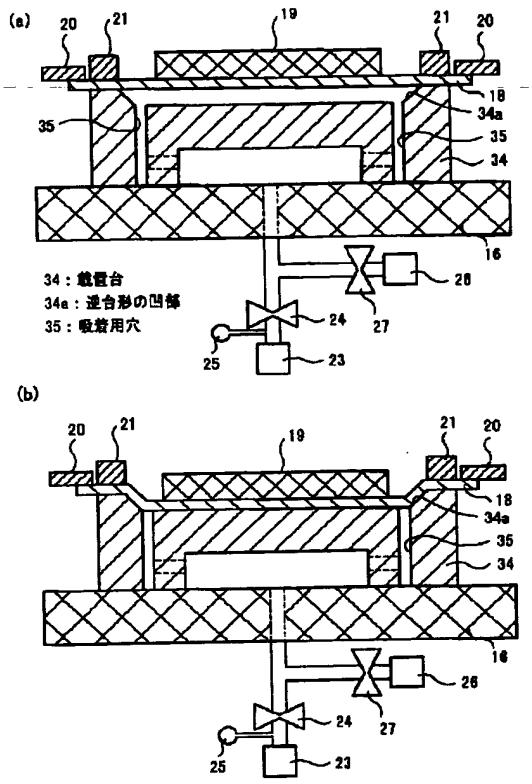


32：レーザ光
32a：反射光
33：載置台

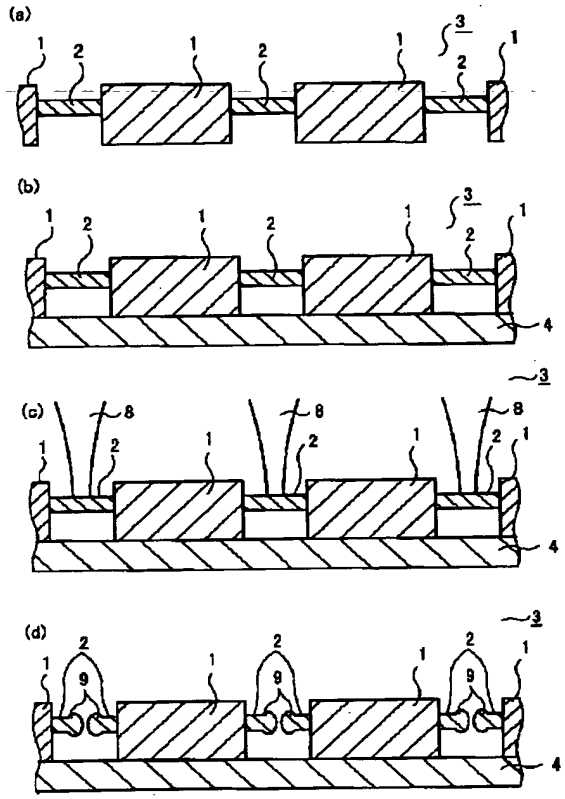
【図６】



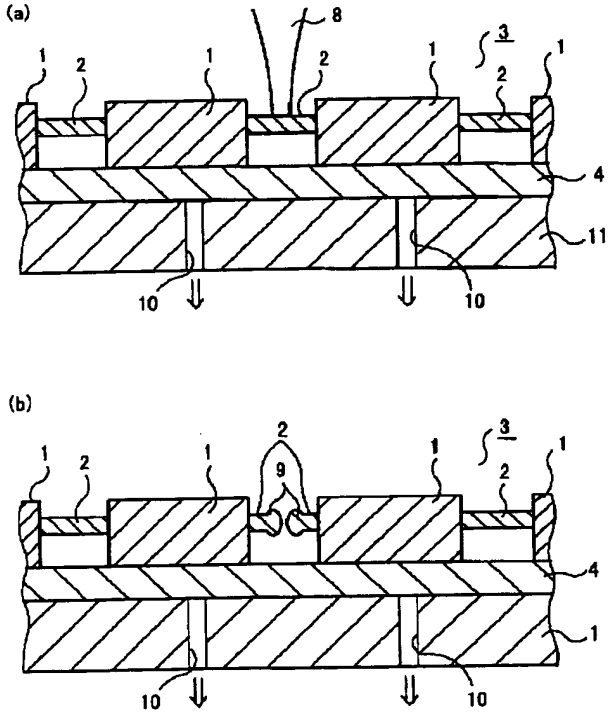
【図４】



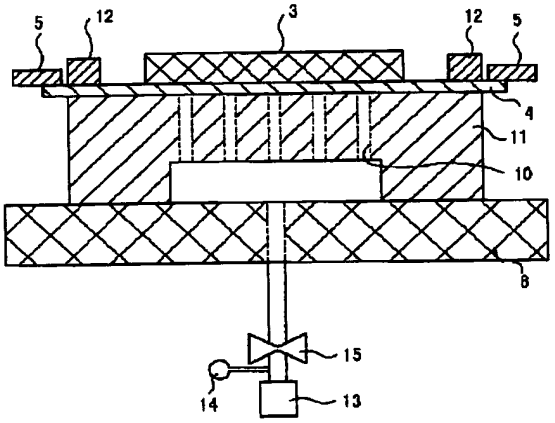
【図５】



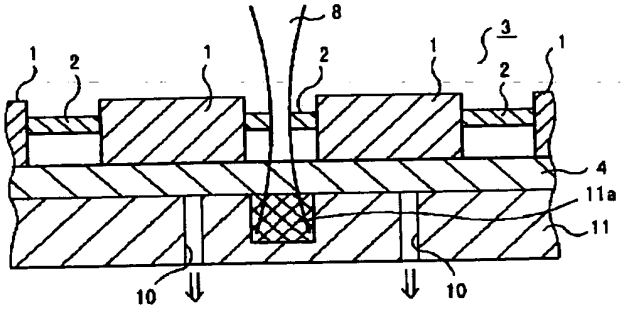
【図７】



【図８】



【図９】



フロントページの続き

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